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CXVI. *An Account of a Treatise, in Latin, presented and dedicated to the Royal Society, intituled, "Gottlob Caroli Springsfeld, "M. D. &c. &c. commentatio de prerogativa Thermarum Carolinarum in dissolvendo calculo vesicæ præ aqua cal-cis vivæ," by William Watfon, Member of the Royal Academy of Physicians at Madrid, and F. R. S.*

Read Dec. 23, 1756. **D**R. Springsfeld's Treatise, which he lately communicated to the Royal Society, contains a series of experiments and observations upon the Carlsbad waters in Bohemia, as a solvent for the stone in the bladder; from whence it appears, that these waters have that property in a much higher degree than even lime-water. The Carlsbad waters have been long celebrated for their excellent effects in removing, or at least relieving, many of the disorders to which mankind is subject. How high they stood in the opinion of the great Hoffman almost every part of his writings bears testimony; and if to their other before-known properties they should prove a safe, easy, and effectual solvent for the stone in the kidneys and bladder, it certainly would greatly enhance their value.

Our author has very attentively considered the writings of Doctors Jurin, Hales, Hartley, Whytt, and others, concerning solvents for the stone. He has administered to several patients, with little or no

success, the late Mrs. Stephens's medicine, with the strictest observance of all the cautions, said to be necessary in courses of that medicine. And, though he allows every thing to be true that has been laid down by Dr. Whytt and others in relation to oyster-shell lime-water, he does not scruple to assert, that the Carlsbad waters, which, as will hereafter appear, have great analogy to calcarious waters, are a far more excellent solvent for the stone in the kidneys and bladder than any lime-water. Of this truth he is satisfied by various experiments, several of which were made by himself alone, and others in conjunction with our learned and ingenious brother Dr. Lieberkuhn, whose exactness as well as fidelity in making experiments of this kind no one will question.

Dr. Springsfeld, in a treatise upon the Carlsbad waters, published by him in the year 1749, has shewn by undoubted experiments, that these waters partake always of an alkaline principle; for every pint of them, besides the neutral purging salt, contains three grains of alkaline salt, and ten grains of calcarious earth; for which reason they ferment with every species of acids. I before mentioned, that these waters have great analogy with lime-water; and if they continue in the baths for any considerable time, they not only turn milky, like lime-water, but have a pellicle upon them as that water is observed to have. They have likewise a gently constringing taste; that was it not for their saline taste they could not easily be distinguished from lime-water.

It must here be premised, that all hard bodies, viz. pieces of wood, bone, stones, earthen vessels, bits of straw, and such-like, are incruited over by
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lying in the Carlsbad waters, and that in a very little time. These bodies in the space of a night will be covered with a tophaceous crust, which continually increases. But human calculi, though hard in themselves, are not incruited thereby; but are rather dissolved; which is the more remarkable. The same effects are observed upon pieces of the hardest cheese, which swell in these waters, and are changed into a kind of pultice.

In the treatise before us our author has given the detail of many experiments, which prove the solvent power of these waters. I shall lay a few of them only before you, from which an opinion both of our author's exactness in making them, as well as how far he is justified in his conclusions, may be formed. And here I must observe, which should be a very comfortable consideration for the inhabitants in these parts, that our author has been obliged frequently to suspend his researches for want of human calculi, which is a disease exceedingly rare in Bohemia.

June 20, 1749. A stone of a brown colour, which weighed near two ounces and half, was placed in a china basin near that source, which is called Brudel, in such a manner as to be continually covered with the warm water. Upon the next day the external crust began to grow soft; upon the third, you might make an impression thereupon with your nail as upon cheese; upon the fourth and fifth, it was dissolved to the nucleus; upon the sixth, the nucleus itself was dissolved, and in the bottom of the basin there was left a white viscid mass, like pultice, or newly steeped cheese: this was impalpable between the

the fingers. In this time the bafon was incrufted with a very hard tophaceous mafs, of the thicknefs of a quill. Certain calculi, not bigger than peafe, were diffolved thoroughly, fome in one day and the reft in two.

1750. June 12. A ftone, weighing more than half an ounce, was placed in the fame manner as the former, and not a grain of it remained on the fourth day. At this time a clergyman, who was in a courfe of thefe waters for gouty complaints, voided fix ftones, which all were diffolved in the fame manner.

A nobleman, who was afflicted with bloody urine, from calculi in the kidneys, came to Carlsbad for the relief of his complaints; and brought with him fome fmall calculi, which he had voided a few years before. By Dr. Lieberkuhn's advice Dr. Springsfeld divided thefe calculi into four equal parts, each of which weighed fix grains. One part of thefe was infufed in the water of the fource called Brudel; the fecond, in the New Spring; the third, in that near the mill. In twelve hours the firft part had loft five grains; the fecond, four; and the third, only one grain. The fourth portion was put upon a linen rag, which was ftretched over the bottom of a funnel. Into this funnel the nobleman was directed to make water every day before dinner, after his having drank his quantity of Carlsbad water. Upon this, thefe calculi, after eight days, had loft two-thirds of their weight; viz. four grains. It muft be here remarked, that this nobleman, during the regimen, did void feveral fmall calculi, which he had not done for fome years. A larger quantity of bloody urine than ufual attended the parting with thefe ftones; but

but this continued only two or three days, and afterwards went quite off; and this nobleman from that time was relieved from his former complaints, has enjoyed and does yet enjoy the most perfect health.

In the year 1754, our author became possessed of a calculus, which was of a flinty hardness, and bore a bright polish. It weighed a quarter of an ounce. He conjectured, that a much longer time would be necessary to dissolve this stone; but what was very remarkable it dissolved sooner than the rest: for after having been immersed twenty-four hours, two grains of it only remained undissolved. This stone was not placed in the china basin as the others were, but suspended in a little loose-woven net, that it might more freely be washed by the water. Dr. Lieberkuhn was at this time at Carlsbad; he was present at this experiment, and was witness of its truth. The net used in this experiment was covered with a tephaceous crust, from being steeped in the water.

The next year, when Dr. Lieberkuhn returned to Carlsbad, he brought with him, for experiment-sake, several calculi, some of which were large ones. He made there many experiments, in which our author assisted. A large stone was sawed into four pieces nearly equal. One of these, weighing 99 grains, was put into a little linen bag, and immersed in the source called Brudel: the second, in like manner, which weighed 96 grains, into that called the New Spring: the third, weighing 93 grains, into that near the mill: the fourth was set apart for other trials. After four days immersion they were severally examined. The first had lost 85 grains; the second, thirty.

thirty-three grains; the third, only 16 grains. That it might be estimated in what degree the solvent power of the Carlsbad water did exceed that of lime-water, the following experiment was tried. Three pieces of calculi, each exactly thirty grains in weight, were put into separate phials. Upon one was poured some fresh egg-shell lime-water: upon the second, some Carlsbad water: upon the third, some of the urine of a person daily drinking these waters for the recovery of his health. These phials were all placed in one of the canals, which carries off the waste water from the baths: the degree of heat in this place was by Fahrenheit's thermometer 96, much the same as the heat of human blood. The lime-water, the Carlsbad water, and the urine, were changed every day, and the process continued for fourteen days. Upon the fifteenth, the remaining fragments of stone were taken out of the phials, and weighed when dried. The piece macerated in lime-water had lost one grain: that in the Carlsbad water, six grains: that in the urine, five grains. According therefore to this experiment the solvent power of the Carlsbad water was six times, that of the urine five times greater than that of the lime-water.

The solvent power of medicated urine is of very great importance, and requires more particular attention; as our greatest expectations in dissolving the stone in the bladder must arise from that. It was therefore very fit that our author should investigate, as far as was in his power, the solvent property of the urine of those who drank these waters. He therefore suspended to the end of a funnel a sufficiently hard and compact calculus, weighing about an ounce.

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This was contained in a linen rag, so that the urine might readily pass over it; and a person, who used the Carlsbad waters every morning, after having taken them, constantly made water into that funnel; from whence it came to pass, that on the sixteenth day the stone was half dissolved, and the remaining part was become so porous and friable, that it almost fell to pieces. No one can suppose that the urine of a man perfectly in health would have the same solvent property; lest however that should happen, our author suspended a piece of a calculus, weighing two drams, in the same manner with the preceeding, and made water upon it himself many times a day: but this piece of calculus, after twelve days, was so far from being lessened, that it had increased two grains in weight.

Our author, lest he should be thought to have depended too much upon one set of experiments, made others. Among several calculi, which Dr. Lieberkuhn had communicated to him, there was one exceedingly hard. This he cut into four parts, each weighing exactly eighty grains. Each of these was put into a separate phial. Upon the first was poured fresh oyster-shell lime-water: upon the second, Carlsbad water: upon the third, the urine of one who drank these waters: upon the fourth, the urine of one perfectly in health, and who only drank for his breakfast some cups of tea. These phials were placed in the same manner with those before-mentioned, and their heat kept constantly the same. Every day these calculi had fresh liquid poured upon them after the old was separated. At the end of twenty days these stones were dried and weighed. The fragment in-

fused in oyster-shell lime-water was found to have lost almost three grains: that in Carlsbad water twenty-two grains: that in medicated urine fourteen grains: but that infused in the urine of the man in health had increased three grains. These experiments therefore leave no room to doubt of, either the solvent power of the Carlsbad water itself, or that of the urine of those who drink these waters.

Our author has a very curious remark in relation to a person who laboured under the stone, and who drank these waters for two months. He daily voided with his urine a large quantity of white viscid mucus; which, after filtration of the aqueous parts from it, was found to be a white earthy powder, rubbed off as it were from a stone. The quantity of this powder saved during the space of a month amounted to more than three ounces. If some of this powder was put into the urine of one who drank Carlsbad water, it was immediately converted into a pultaceous substance; but if into that of one, who did not drink this water, it fell quite undissolved to the bottom of the vessel.

Dr. Springsfeld observes, that the Carlsbad water has great power in dissolving the tophaceous crust, which frequently covers the teeth. During the course of these waters, this crust most generally separates from the teeth, and falls off.

However great the power of these waters are in dissolving the stone in the bladder, they have a quite contrary effect upon gall stones. So far from dissolving these last, our author has frequently found that these waters envelope them with their tophaceous crust. Our ingenious brother Dr. Whytt has
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observed, that lime-water has no solvent power upon gall stones. Hence we draw another proof of the analogy of lime-water with Carlsbad water.

If it should be wondered at, how it comes to pass that the urine of those who drink these waters should have the power of dissolving the stone, it is necessary to inform our readers, that this urine contains nearly the same properties which the water originally had. It has before been observed, that these waters are impregnated with an alkaline principle, and consequently ferment with acids. The urine of those who drink them, if made before dinner, has the very same quality as our author has frequently experienced; especially if the accustomed quantity of water is taken, and nothing else is drank upon them. The customary dose at Carlsbad is not less than six, seven, or eight pints of water taken every morning: for which reason we are not to wonder that the urine has the property of dissolving the stone in the kidneys and bladder, if it is long retained. And our author makes no scruple, but that the injection of these waters into the bladder would be very powerful in relieving calculous complaints; though this he had never tried; neither was he much induced thereto, as the urine is possessed of all the powers which he was in search of.

It remains that we just take notice, by what means these waters are possessed of their solvent power. It is well known, that acids, more especially mineral ones, do dissolve animal calculi, by acting upon their terrestrial parts, dividing their masses, and becoming neutral thereby. These effects do not arise from alcalies, as they leave terrestrial substances untouched.

If sometimes we carefully attend to the operations of nature, we now and then make discoveries which must otherwise have escaped us. If we pour nitrous or vitriolic acid upon that stoney substance, which is usually called crabs-eyes, and let them remain in the glass for a considerable time perfectly still, we shall find at the bottom of the vessel, after the terrestrial parts are thoroughly dissolved, a membranous substance or jelly, exactly in size and figure resembling the crabs-eyes, and which the acid had left untouched. Exactly such a gelatinous mass our author has observed in stones of the bladder; more particularly in small ones, after dissolving them in acids. If crabs-eyes are infused in an alkaline lixivium for a considerable time, we see no change in them, which can be properly called a solution: about them we observe a certain viscid appearance like a cloud; if that is taken away, and the crabs-eyes are dried, and afterwards weighed, they have not only lost part of their weight, but are become much more friable; which is a great argument that they have lost something. If afterwards these crabs-eyes are washed with warm water, to carry off the alkaline matter adhering to them, and afterwards set to dissolve in acids, these crabs-eyes, after the solution of their terrestrial parts, leave nothing gelatinous behind them, as they did in the other experiment; from whence it is plain, that the gelatinous substance had been extracted and dissolved by the alkaline lixivium. The very same thing happens to the human calculus.

It appears therefore more than probable to our author, that lime-water and Carlsbad waters, on account of their alike partaking of the alkaline and calcarious principle,

principle, do dissolve the before-mentioned animal gluten only, by which the terrestrial parts are united together ; and upon the solution of which these parts must separate and fall asunder. From hence may be accounted for also the origin of that white viscid matter, which adheres to the bottom of the vessel like pultice, after the dissolution of calculi in the Carlsbad waters ; and which is nothing more than the terrestrial parts of the stone deprived of the animal gluten, which makes them adhere together. Hence we see the reason why our predecessors adopted two sorts of lithontriptic remedies, and those of quite opposite properties. Basil Valentine, Paracelsus, Helmont, and others, administered alcalies : Sylvius, Laurembergius, and Dippelius, acids. By these last they attempted to dissolve the terrestrial parts ; by the former, the connecting gluten. But the case in gall stones is different : their connecting gluten, which unites the bilious parts, is not an animal jelly, as in the *calculus vesicæ*, but a fat inflammable oil, which is neither dissoluble by the Carlsbad waters nor by lime-water.

Our author conjectures that he has proved demonstratively, that the solvent power of the Carlsbad waters does exceed that of lime-water ; besides which it has this advantage, that it is not in the least nauseous, and may be continued, if necessary, for six or eight months, without any other inconvenience than that of drinking them upon the spot ; which may indeed oblige persons whose dwellings are remote from Carlsbad to take a journey thither ; whereas lime-water may be drank at home.

I have been the more copious in my account of the work before us, as the subject of it is very interesting; one, in which some of our brethren have remarkably distinguished themselves, which occasioned Dr. Springsfeld to dedicate his performance to this learned Society. The experiments in his work, of which there are many, are well devised, and to appearance carefully executed. He has not attempted to amuse us with vain and fruitless speculations; but, on the contrary, has nobly turned his thoughts towards obviating the distresses, and relieving the miseries, to which human life is unhappily subject.

W. Watfon.

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